

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Industrial communication networks – Fieldbus specifications –  
Part 6-15: Application layer protocol specification – Type 15 element**

**Réseaux de communication industriels – Spécifications des bus de terrain –  
Partie 6-15: Spécification des protocoles des couches d'application –  
Éléments de Type 15**

IEC 61158-6-15:2007

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Partie 6-15: Spécification des protocoles des couches d'application –  
Éléments de Type 15**

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# CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
1.1 General.....	9
1.2 Specifications.....	9
1.3 Conformance.....	9
2 Normative references.....	10
3 Terms and definitions, abbreviations, symbols and conventions.....	10
3.1 Terms and definitions.....	10
3.2 Abbreviations and symbols.....	17
3.3 Conventions.....	18
3.4 Conventions used in state machines.....	20
4 Abstract syntax for client/server.....	22
5 Transfer syntax for client/server.....	22
5.1 General.....	22
5.2 Common APDU structure.....	22
5.3 Service-specific APDU structures.....	26
5.4 Data representation 'on the wire'.....	50
6 Abstract syntax for publish/subscribe.....	50
7 Transfer syntax for publish/subscribe.....	51
7.1 General.....	51
7.2 APDU structure.....	51
7.3 Sub-message structure.....	52
7.4 APDU interpretation.....	54
7.5 Service specific APDU structures.....	56
7.6 Common data representation for publish/subscribe.....	77
8 Structure of FAL protocol state machines.....	82
9 AP-context state machines for client/server.....	84
10 FAL service protocol machine (FSPM) for client/server.....	84
10.1 General.....	84
10.2 FSPM state tables.....	84
10.3 Functions used by FSPM.....	90
10.4 Parameters of FSPM/ARPM primitives.....	90
10.5 Client/server server transactions.....	90
11 Application relationship protocol machines (ARPMs) for client/server.....	91
11.1 Application relationship protocol machines (ARPMs).....	91
11.2 AREP state machine primitive definitions.....	93
11.3 AREP state machine functions.....	94
12 DLL mapping protocol machine (DMPM) for client/server.....	94
12.1 AREP mapping to data link layer.....	94
12.2 DMPM states.....	95
12.3 DMPM states.....	95
12.4 Primitives exchanged between data link layer and DMPM.....	95
12.5 Client/server on TCP/IP.....	96
13 AP-Context state machines for publish/subscribe.....	97

14 Protocol machines for publish/subscribe.....	97
14.1 General.....	97
14.2 Publish/subscribe on UDP.....	99
Bibliography.....	100
Figure 1 – APDU Format.....	22
Figure 2 – Client to server confirmed service request.....	24
Figure 3 – Normal response from server to client.....	24
Figure 4 – Exception response from server to client.....	24
Figure 5 – Client to server unconfirmed service request.....	25
Figure 6 – Publish/subscribe APDU.....	51
Figure 7 – Relationships among protocol machines and adjacent layers.....	83
Figure 8 – State transition diagram of FSPM.....	84
Figure 9 – Client/server server transactions.....	91
Figure 10 – State transition diagram of the client ARPM.....	92
Figure 11 – State transition diagram of the server ARPM.....	92
Figure 12 – State transition diagram of DMPM.....	95
Figure 13 – APDU format.....	96
Figure 14 – TCP/IP PDU format.....	97
Figure 15 – Publish/subscribe receiver.....	98
Table 1 – Conventions used for state machines.....	21
Table 2 – Exception code.....	25
Table 3 – Read discretely request.....	26
Table 4 – Read discretely response.....	26
Table 5 – Read coils request.....	27
Table 6 – Read coils response.....	27
Table 7 – Write single coil request.....	28
Table 8 – Write single coil response.....	28
Table 9 – Write multiple coils request.....	29
Table 10 – Write multiple coils response.....	29
Table 11 – Broadcast write single coil request.....	30
Table 12 – Broadcast write multiple coils request.....	31
Table 13 – Read input registers request.....	31
Table 14 – Read input registers response.....	32
Table 15 – Read holding registers request.....	32
Table 16 – Read holding registers response.....	33
Table 17 – Write single holding register request.....	33
Table 18 – Write single holding register response.....	34
Table 19 – Write multiple holding registers request.....	34
Table 20 – Write multiple holding registers response.....	35
Table 21 – Mask write holding register request.....	36
Table 22 – Mask write holding register request.....	36

Table 23 – Read/Write multiple holding registers request.....	37
Table 24 – Read/Write multiple holding registers response .....	37
Table 25 – Read FIFO request.....	38
Table 26 – Read FIFO response .....	38
Table 27 – Broadcast write single holding register request.....	39
Table 28 – Broadcast write multiple holding registers request .....	40
Table 29 – Read file record request .....	41
Table 30 – Read file record response .....	42
Table 31 – Write file record request .....	43
Table 32 – Write file record response .....	45
Table 33 – Read device identification request.....	46
Table 34 – Device identification categories .....	47
Table 35 – Read device ID code .....	47
Table 36 – Read device identification response .....	48
Table 37 – Conformity level .....	49
Table 38 – Requested vs. returned known objects .....	50
Table 39 – APDU structure .....	52
Table 40 – Sub-message structure .....	53
Table 41 – Publish/subscribe service identifier encoding .....	53
Table 42 – Attributes changed modally and affecting APDUs interpretations .....	55
Table 43 – Issue request .....	56
Table 44 – Flags of issue request .....	57
Table 45 – Meaning of issue request flags .....	57
Table 46 – Interpretation of issue .....	58
Table 47 – Heartbeat request .....	59
Table 48 – Flags of heartbeat request.....	59
Table 49 – Meaning of heartbeat request flags .....	60
Table 50 – Interpretation of heartbeat .....	61
Table 51 – VAR request.....	62
Table 52 – Flags of VAR request .....	63
Table 53 – Meaning of VAR request flags .....	63
Table 54 – Interpretation of VAR.....	64
Table 55 – GAP request.....	65
Table 56 – Flags of GAP request .....	65
Table 57 – Meaning of GAP request flags .....	66
Table 58 – Interpretation of GAP.....	66
Table 59 – ACK request.....	67
Table 60 – Flags of ACK request .....	67
Table 61 – Meaning of ACK request flags .....	68
Table 62 – Interpretation of ACK.....	68
Table 63 – Header request .....	69
Table 64 – Change in state of the receiver.....	70
Table 65 – INFO_DST request.....	70

Table 66 – Flags of INFO_DST request .....	71
Table 67 – Meaning of INFO_DST request flags .....	71
Table 68 – INFO_REPLY request .....	72
Table 69 – Flags of INFO_REPLY request .....	72
Table 70 – Meaning of INFO_REPLY request flags .....	73
Table 71 – INFO_SRC request .....	74
Table 72 – Flags of INFO_SRC request .....	74
Table 73 – Meaning of INFO_SRC request flags .....	74
Table 74 – INFO_TS request .....	75
Table 75 – Flags of INFO_TS request .....	76
Table 76 – Meaning of INFO_TS request flags .....	76
Table 77 – PAD request .....	77
Table 78 – Flags of PAD request .....	77
Table 79 – Meaning of PAD request flags .....	77
Table 80 – Semantics .....	78
Table 81 – FSPM state table – client transactions .....	85
Table 82 – FSPM state table – server transactions .....	90
Table 83 – Function MatchInvokeID() .....	90
Table 84 – Function HighBit() .....	90
Table 85 – Parameters used with primitives exchanged between FSPM and ARPM .....	90
Table 86 – Client ARPM states .....	92
Table 87 – Client ARPM state table .....	92
Table 88 – Server ARPM states .....	92
Table 89 – Server ARPM state table .....	93
Table 90 – Primitives issued from ARPM to DMPM .....	93
Table 91 – Primitives issued by DMPM to ARPM .....	93
Table 92 – Parameters used with primitives exchanged between ARPM and DMPM .....	93
Table 93 – DMPM state descriptions .....	95
Table 94 – DMPM state table – client transactions .....	95
Table 95 – DMPM state table – server transactions .....	95
Table 96 – Primitives exchanged between data-link layer and DMPM .....	96
Table 97 – Encapsulation parameters for client/server on TCP/IP .....	96

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**INDUSTRIAL COMMUNICATION NETWORKS –  
FIELD BUS SPECIFICATIONS –****Part 6-15: Application layer protocol specification – Type 15 elements**

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International Standard IEC 61158-6-15 has been prepared by subcommittee 65C: Industrial networks, of IEC technical committee 65: Industrial-process measurement, control and automation.

This first edition and its companion parts of the IEC 61158-6 subseries cancel and replace IEC 61158-6:2003. This edition of this part constitutes a technical addition. This part and its Type 15 companion parts also cancel and replace IEC/PAS 62030, published in 2005.

This edition of IEC 61158-6 includes the following significant changes from the previous edition:



- a) deletion of the former Type 6 fieldbus for lack of market relevance;
- b) addition of new types of fieldbuses;
- c) partition of part 6 of the third edition into multiple parts numbered -6-2, -6-3, ...

This bilingual version (2014-12) corresponds to the monolingual English version, published in 2007-12.

The text of this standard is based on the following documents:

FDIS	Report on voting
65C/476/FDIS	65C/487/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under <http://webstore.iec.ch> in the data related to the specific publication. At this date, the publication will be:

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

NOTE The revision of this standard will be synchronized with the other parts of the IEC 61158 series.

The list of all the parts of the IEC 61158 series, under the general title *Industrial communication networks – Fieldbus specifications*, can be found on the IEC web site.

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## INTRODUCTION

This part of IEC 61158 is one of a series produced to facilitate the interconnection of automation system components. It is related to other standards in the set as defined by the “three-layer” fieldbus reference model described in IEC/TR 61158-1.

The application protocol provides the application service by making use of the services available from the data-link or other immediately lower layer. The primary aim of this standard is to provide a set of rules for communication expressed in terms of the procedures to be carried out by peer application entities (AEs) at the time of communication. These rules for communication are intended to provide a sound basis for development in order to serve a variety of purposes:

- as a guide for implementors and designers;
- for use in the testing and procurement of equipment;
- as part of an agreement for the admittance of systems into the open systems environment;
- as a refinement to the understanding of time-critical communications within OSI.

This standard is concerned, in particular, with the communication and interworking of sensors, effectors and other automation devices. By using this standard together with other standards positioned within the OSI or fieldbus reference models, otherwise incompatible systems may work together in any combination.

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## INDUSTRIAL COMMUNICATION NETWORKS – FIELDBUS SPECIFICATIONS –

### Part 6-15: Application layer protocol specification – Type 15 elements

#### 1 Scope

##### 1.1 General

The fieldbus Application Layer (FAL) provides user programs with a means to access the fieldbus communication environment. In this respect, the FAL can be viewed as a “window between corresponding application programs.”

This standard provides common elements for basic time-critical and non-time-critical messaging communications between application programs in an automation environment and material specific to Type 15 fieldbus. The term “time-critical” is used to represent the presence of a time-window, within which one or more specified actions are required to be completed with some defined level of certainty. Failure to complete specified actions within the time window risks failure of the applications requesting the actions, with attendant risk to equipment, plant and possibly human life.

This standard defines in an abstract way the externally visible behavior provided by the Type 15 fieldbus Application Layer in terms of

- a) the abstract syntax defining the application layer protocol data units conveyed between communicating application entities,
- b) the transfer syntax defining the application layer protocol data units conveyed between communicating application entities,
- c) the application context state machine defining the application service behavior visible between communicating application entities; and
- d) the application relationship state machines defining the communication behavior visible between communicating application entities; and.

The purpose of this standard is to define the protocol provided to

- 1) define the wire representation of the service primitives defined in IEC 61158-5-15, and
- 2) define the externally visible behavior associated with their transfer.

This standard specifies the protocol of the Type 15 IEC fieldbus Application Layer, in conformance with the OSI Basic Reference Model (ISO/IEC 7498) and the OSI Application Layer Structure (ISO/IEC 9545).

##### 1.2 Specifications

The principal objective of this standard is to specify the syntax and behavior of the application layer protocol that conveys the application layer services defined in IEC 61158-5-15.

A secondary objective is to provide migration paths from previously-existing industrial communications protocols. It is this latter objective which gives rise to the diversity of protocols standardized in IEC 61158-6.

##### 1.3 Conformance

This standard does not specify individual implementations or products, nor does it constrain the implementations of application layer entities within industrial automation systems.

Conformance is achieved through implementation of this application layer protocol specification.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61158-5-15, *Industrial communication networks – Fieldbus specifications – Part 5-15: Application layer service definition – Type 15 elements*

ISO/IEC 7498-1, *Information technology – Open Systems Interconnection – Basic Reference Model – Part 1: The Basic Model*

ISO/IEC 9545, *Information technology – Open Systems Interconnection – Application Layer structure*

ISO/IEC 8822, *Information technology – Open Systems Interconnection – Presentation service definition*

ISO/IEC 8824, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1)*

## 3 Terms and definitions, abbreviations, symbols and conventions

### 3.1 Terms and definitions

For the purposes of this document, the following terms as defined in these publications apply:

#### 3.1.1 ISO/IEC 7498-1 terms

- a) application entity
- b) application process
- c) application protocol data unit
- d) application service element
- e) application entity invocation
- f) application process invocation
- g) application transaction
- h) real open system
- i) transfer syntax

#### 3.1.2 ISO/IEC 8822 terms

- a) abstract syntax
- b) presentation context

#### 3.1.3 ISO/IEC 9545 terms

- a) application-association
- b) application-context
- c) application context name
- d) application-entity-invocation
- e) application-entity-type

- f) application-process-invocation
- g) application-process-type
- h) application-service-element
- i) application control service element

#### **3.1.4 ISO/IEC 8824 terms**

- a) object identifier
- b) type

#### **3.1.5 IEC/TR 61158-1 terms**

The following IEC/TR 61158-1 terms apply.

##### **3.1.5.1 application**

function or data structure for which data is consumed or produced

##### **3.1.5.2 application layer interoperability**

capability of application entities to perform coordinated and cooperative operations using the services of the FAL

##### **3.1.5.3 application object**

object class that manages and provides the run time exchange of messages across the network and within the network device

NOTE Multiple types of application object classes may be defined.

##### **3.1.5.4 application process**

part of a distributed application on a network, which is located on one device and unambiguously addressed

##### **3.1.5.5 application process identifier**

distinguishes multiple application processes used in a device

##### **3.1.5.6 application process object**

component of an application process that is identifiable and accessible through an FAL application relationship

NOTE Application process object definitions are composed of a set of values for the attributes of their class.

##### **3.1.5.7 application process object class**

class of application process objects defined in terms of the set of their network-accessible attributes and services

##### **3.1.5.8 application relationship**

cooperative association between two or more application-entity-invocations for the purpose of exchange of information and coordination of their joint operation

NOTE This relationship is activated either by the exchange of application-protocol-data-units or as a result of preconfiguration activities.

### 3.1.5.9 application relationship endpoint

context and behavior of an application relationship as seen and maintained by one of the application processes involved in the application relationship

NOTE Each application process involved in the application relationship maintains its own application relationship endpoint.

### 3.1.5.10 application service element

application-service-element that provides the exclusive means for establishing and terminating all application relationships

### 3.1.5.11 attribute

description of an externally visible characteristic or feature of an object

NOTE The attributes of an object contain information about variable portions of an object. Typically, they provide status information or govern the operation of an object. Attributes may also affect the behaviour of an object. Attributes are divided into class attributes and instance attributes.

### 3.1.5.12 behaviour

indication of how the object responds to particular events

NOTE Its description includes the relationship between attribute values and services.

### 3.1.5.13 class

set of objects, all of which represent the same kind of system component

NOTE A class is a generalisation of the object; a template for defining variables and methods. All objects in a class are identical in form and behaviour, but usually contain different data in their attributes.

### 3.1.5.14 class attributes

attribute that is shared by all objects within the same class

### 3.1.5.15 class code

unique identifier assigned to each object class

### 3.1.5.16 class specific service

service defined by a particular object class to perform a required function which is not performed by a common service

NOTE A class specific object is unique to the object class which defines it.

### 3.1.5.17 Client

a) object which uses the services of another (server) object to perform a task

b) initiator of a message to which a server reacts, such as the role of an AR endpoint in which it issues confirmed service request APDUs to a single AR endpoint acting as a server

### 3.1.5.18 conveyance path

unidirectional flow of APDUs across an application relationship

### 3.1.5.19 cyclic

term used to describe events which repeat in a regular and repetitive manner